Format:
Póster: P_BB_33

Symposium:
BIOENERGY AND BIOPRODUCTS

Title:
Implementation of a cellulase recycling system to the hydrolysis of recycled paper sludge

Authors:
Domingues L, Gomes D, Gama M
Institution – Company:
Centre of Biological Engineering
E-mail:
danielg_gomes@deb.uminho.pt
Keywords:
cellulase recycling; recycled paper sludge; 2G-bioethanol; bio-refinery; bioremediation

Abstract:
Although 2G-biofuels have been implemented in some countries for some decades now, its economic viability remains an important drawback, hampering it to compete with fossil fuels. Great attention has been given to the discovery of new lignocellulosic substrates and strategies to reduce the amount of enzyme required for this process, both representing critical factors on the process economics.
Recycled paper sludge (RPS) is an cellulosic residue obtained from paper recycling process, being mostly incinerated or disposed in landfills. In spite of being comprised by a considerable carbohydrates content, very few studies have exploited this potential. Similarly, although several works have studied the profiles of enzyme adsorption/desorption on lignocellulosic substrates, strategies of cellulase recycling have poorly been implemented so far. Here, we describe the implementation of a cellulase recycling system for the particular case of RPS hydrolysis.
Following preliminary results suggesting RPS suitability to be hydrolysed and later fermented, the distribution of enzymes at the end of hydrolysis was initially investigated. For a moderate enzyme loading, 20 FPU/gcellulose, and 5 % solids, 80 % of final Cel7A activity was found in the liquid fraction, and thus can be easily recovered and reutilized in a new round. Solid-bound enzymes, which still correspond to 20 %, were efficiently recovered to an extent around 85 % applying a simple alkaline wash, enabling its equal reutilization for a new hydrolysis. Following these results, 4 consecutive rounds of hydrolysis were conducted with this substrate recovering both cellulase fractions at the end of each round. Additionally, a portion of fresh enzyme, corresponding to 20 % of the original load, was added at each round to compensate activity loss.
Ethanol was produced in all rounds although with a decrease over the process, possibly reflecting a reduction on substrate saccharification. Nonetheless, this system enabled a reduction of 60 % on process enzyme corresponding to a significant improvement in the process economics. These results also demonstrate that RPS, a residue that has been widely ignored so far, can be hydrolysed, fermented and is suitable for cellulase recycling, and thus have huge potential to be employed in a bio-refinery context.